from Auckland, New Zealand, says a violent eruption of the volcano Waimangu began Sunday and still continues. Two persons have been killed. (Assoc. Press.)

St. Louis, Mo., Apr. 9, 1917.

A distinct earthquake shock was felt for several seconds this afternoon throughout this section. A number of windows were broken and several chimneys were knocked down. The after-vibrations continued for eight minutes. (Assoc. Press.)

[See Table 1 and note hereunder, this issue of the REVIEW.]

Santa Barbara, Cal., Apr. 12, 1917.

A severe earthquake shock was felt here at 8 o'clock to-night. No damage was done. Ventura and Oxnard, 20 and 30 miles east, respectively, along the coast, also felt the shock but experienced no damage. (Assoc. Press.)

Los Angeles, Cal., Apr. 20, 1917.

Two earthquake shocks in rapid succession were felt in various parts of southern California late to-night. No damage was reported. (Assoc. Press.)

London, Apr. 27, 1917, 8:38 a. m.

A violent earthquake in Tuscany and Umbria is reported in a Rome dispatch to the Exchange Telegraph Co. to have occurred on Thursday morning. Many persons are reported killed at Monterchi, near Arezzo, the capital of the Province of that name. Considerable material damage is also reported. (Assoc. Press.)

Rome, Apr. 30, 1917.

Earthquake shocks were reported at Monterchi to-day, the same district laid waste by earth tremors last week. (United Press.)

THE MISSOURI EARTHQUAKE OF APRIL 9, 1917.

By RUY H. FINCH, Assistant.

[Seismological Investigations, Weather Bureau, May 29, 1917.]

On the 9th of April, 1917, a little before 3 p. m., central time, an earthquake occurred near the middle of the eastern border of Missouri that was felt in 10 different States. It was felt over most of Missouri and Illinois, and at many places in Iowa, Wisconsin, Indiana, Kentucky, Tennessee, Mississippi, Arkansas, and Kansas. At first it was thought that the quake had its origin in the New Madrid region, but later reports indicate that the epicenter was somewhere between there and St. Louis.

Most of the information relative to this quake was obtained from some 160 question cards filled out by cooperative observers of the Weather Bureau—postmasters and others—most of whom rendered these reports shortly after the occurrence of the shock while its effects were still fresh in their minds. The majority of the accounts thus received are given in some detail in Table 1, page 182, of this issue of the REVIEW; their intensities and geographical distribution are shown on the accompanying isoseismal map, figure 1.

As was recently pointed out by Montessus de Ballore,[1] the use of isoseismals drawn from estimates of intensities that at best are bound to be at variance is unsatisfactory. Nevertheless such isoseismals give a better idea of the relative distribution of intensities than would be had if omitted.

The area over which this quake was felt, elliptical in shape, extends about 600 miles in a north-south direction and over 500 miles east-west, covering approximately 200,000 square miles. In addition to being both felt and instrumentally recorded at St. Louis University, St. Louis, Mo., and the University of Kansas, Lawrence, Kans., slight records were also obtained at St. Ignatius College, Cleveland, Ohio, about 520 miles away, and the Weather Bureau, Washington, D. C., about 760 miles from the epicentral region.

The beginning of the disturbance as given by the majority of observers was $2^h\ 52^m$ to $2^h\ 53^m$ p. m. (Central time). The time at origin as calculated from the seismograph record of the University of Kansas was $2^h\ 52^m\ 24^s \pm 5^s$. This is in fair agreement with the record obtained at St. Louis University, within a very short distance of the origin, which began at $2^h\ 52^m\ 30^s$ p. m.

Sounds were quite generally reported within the territory bounded by the V isoseismal. Within the VI isoseismal many places reported that heavy rumbling both preceded and accompanied the shock.

No good evidence as to the direction of the vibrations is at hand, though the majority of the observers thought it was east-west. The observer at Ironton, Mo., Mr. W. H. Delano, says that he looked down and could see the earth rock—rise up and sway back and forth as from west to east.

The damage occasioned by this quake was slight. Some windows were broken, bricks shaken from chimneys, and plaster cracked over most of the territory bounded by the VI isoseismal. Several horses were thrown to the pavement in different parts of St. Louis. A painter working on a ladder in Granite City, Mo., was shaken off and fell into a flower garden but was unharmed. Many people hurriedly left their homes in fright. The school children at Warrenton, Mo., and several other places, were thrown into a panic and were dismissed. As is well known, birds and many other animals are more sensitive to light shocks than human beings. This may explain why a team of horses in Golconda, Ill., were uneasy and restless at the time of the quake while the driver felt nothing.

No preliminary shocks to the main quake were noticed except for a slight tremor that was recorded on April 9 by the seismograph at St. Louis University, $8^h\ 45^m$ a. m. A second shock at $5^h\ 35^m$ p. m. was felt quite generally over most of the southern half of the territory bounded by the V isoseismal and was specially noticeable in the corresponding part within the VI isoseismal. This would lead one to think that the origin was located somewhere in the southern half of the VI isoseismal area.

The middle Mississippi Valley, the southern Appalachian region, the Atlantic Coastal Plain in the vicinity of Charleston, S. C., northern and eastern New York, and New England are the well-known seismic regions of the eastern United States. Most, though by no means all, of the middle Mississippi Valley quakes occur in the New Madrid region. Two quakes, one occurring on May 26, 1909, the other on January 2, 1912, and described by Udden [2] apparently had their origin southwest of Chicago. Scarcely a year passes without one or more quakes being felt in the New Madrid region. One on October 7, 1857, whose origin appears to have been either a little to the south of St. Louis or near New Madrid, was not quite as severe as the one under discussion. Another that occurred on October 31, 1895, was probably the most severe since the great shocks of 1811–12. The last shock of note in this region occurred on December 7, 1915, when an intensity of V Rossi-Forel was reported. Several observers ventured the assertion that the quake under discussion was the most severe since the great New Madrid earthquake, and this may be true for the region about St. Louis but is improbable as regards southeastern Missouri.

Judging from the distance to which the waves of this disturbance was propagated it seems probable that the origin was at some depth below the surface. It is known that a series of faults, running in a general east-west direction, occur in the underlying Paleozoic rock of the central region of this earthquake, and it is probable that the recent shake had its origin in one or more of these faults.

[1] Bull., Seis. soc. America.

[2] Trans., Illinois Academy of science, 1912, 5:—

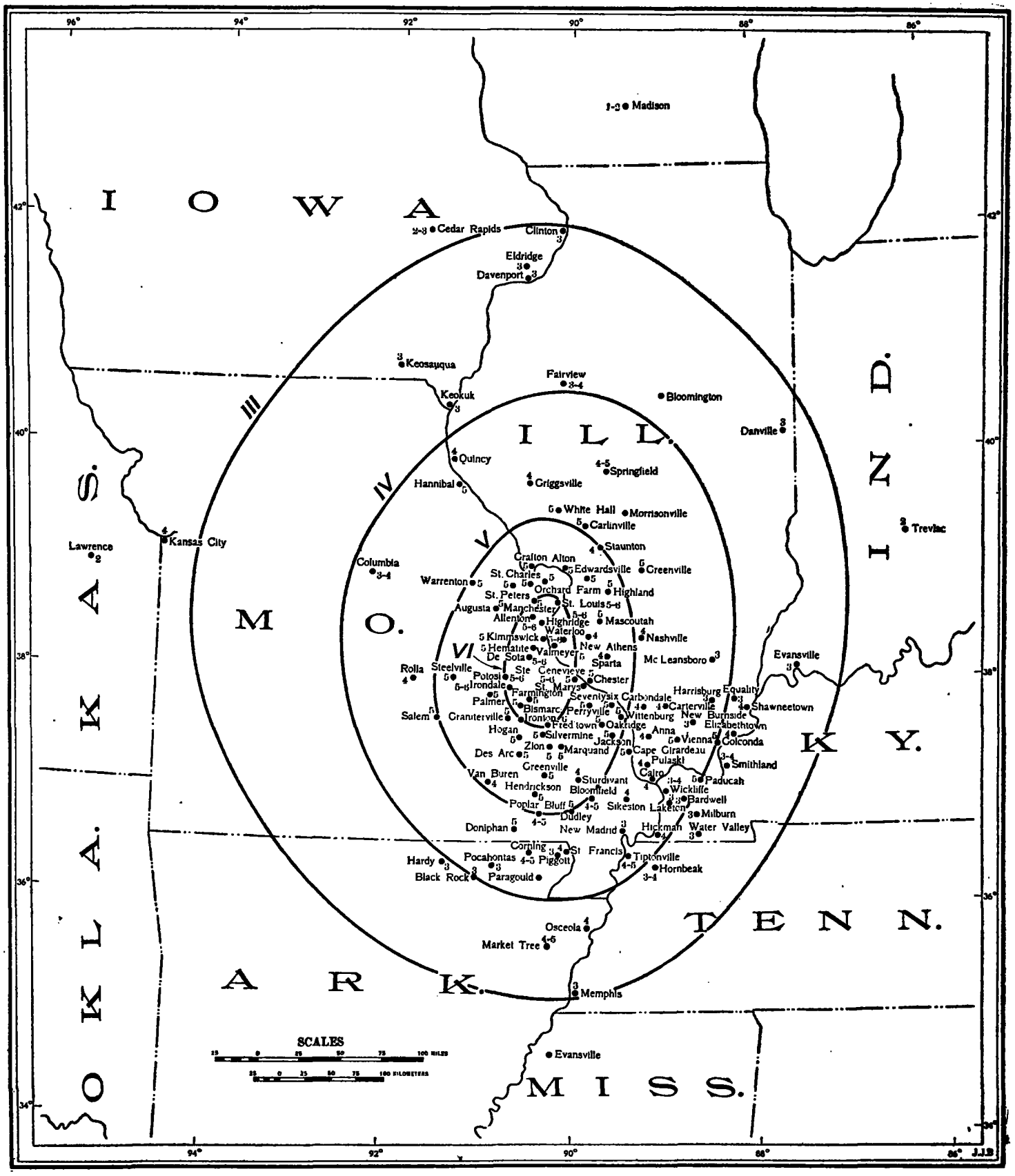

Fig. 1.—Isoseismals of the earthquake of April 9, 1917, in Missouri and Illinois. Arabic numbers opposite places indicate Rossi-Forel intensities.